Kozo Imahori* : **Charophyta in Micronesia****

今堀宏三*: ミクロネシアの輪藻類

There is no important work concerning Micronesian Charophyta, and *Chara gymnopitys* var. *flaccida* (*C. flaccida*) is the only species collected in this area, which was reported by A. Braun (in Hooker's Journ. Bot. & Kew Garden Misc. **1**: 297, 1849). On the other hand, in the neighborhood of Micronesia, viz. Melanesia and Polynesia, considerable works are published. Therefore, it was my earnest desire to study the Charophyta flora of Micronesia, but unfortunately, owing to the War, I could not accomplish my plan.

The following paper is far from complete, but I dare to make a report on this subject, because under present conditions I will not be able to explore these islands again in near future.

I made the journey to Micronesia from July to August in 1939, accompanied by Prof. Y. Horikawa of the Hiroshima University. The islands which we explored are Saipan, Tinian, Yap, Baobeltaob, Korrol and Angaur, but I could not find Charophyta in Angaur and Tinian.

The specimens collected were preserved in about 4 % formalin, and were kept at the Hiroshima University but most of them were lost by the atomic raid. The present paper is a compilation of my herbarium notes and a few specimens luckily escaped the damage at my house.

Three species and one variety of *Nitella* and one species of *Chara* are determined, among which one species and one variety of *Nitella* are new plants and three others are widely distributed tropical or subtropical species.

1. Key to the species of *Nitella* Agardh.

1a. Dactyls strictly one-celled (Arthrodactylae) ·············· 1. *N. acuminata*
1b. Dactyls strictly 2-celled ·· 2
  2a. Decoration of oospore-membrane reticulate ·········· 2. *N. micronesiaca*
  2b. Decorationof oospore-membrane not reticulate ························ 3
 3a. Branchlets furcate 2-3 times, plant rather large ··························
 ···················· ·····3a. *N. pseudoflabellata* var. *mutila*
 3b. Branchlets furcate 1-3 times, plant minute ······························
 3b. *N. pseudoflabellata* var. *minor*

1. **Nitella acuminata** A. Braun in Hooker's Journ. Bot. **1**, 1849, p. 292;

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ibid. in Monatsber. Kön. Akad. Wiss. Berlin, 1858, p. 356; J. Groves in Philipp. Journ. Sci. **19**, 1929, p. 663; ibid. in Journ. Linn. Soc., Bot., **46**, 1922, p. 97; ibid. 1924, pp. 361, 356; G. O. Allen in Journ. Bombay Nat. Hist. Soc. **30**, 1925, p. 597; Groves & Stephens in Transact. Roy. Soc., Bot., **13**, 1926, p. 147; G. O. Allen in Journ. Bot. **65**, 1927, p. 336; ibid. in Journ. Ind. Bot. Soc., **7**, 1928, p. 53; J. Groves in Journ. Linn. Soc., Bot., **48**, 1928, p. 127; Pal in Journ. Burma. Res. Soc., **18**, 1929, p. 113; Dixit in Journ. Ind. Bot Soc. **10**, 1931, p. 206; Migula in Hedwigia **70**, 1931, p. 211; Pal in Journ. Linn. Soc., Bot., **49**, 1932, pp. 64, 66; J. Groves in Journ. Bot., **73**, 1935, p. 49; Zaneveld in Blumea **3**, 1939, pp. 378, 381; ibid. **4**, 1940, p. 54; Wood in Farlowia **3**, 1948, p. 354; Imahori in Journ. Jap. Bot. **22**, 1948, p. 44; in Bot. Mag. Tokyo, **63**, 1950, p. 233.

Hab.: rice-fields and lakelets. Loc.: Korror Isl., July 23, 1939, K. I. No. 119; Galdock lakelet, Baobeltaob Isl., July 28, 1939, K. I. No. 128; Yap Isl., Aug. 18, 1939, K. I. No. 130.

Distr.: Asia (Ceylon, Philippine Isls., India, Burma, Malaya, Formosa and Japan). North and South America, Africa. Not found in Melanesia and Polynesia.

This is the most widely distributed species of Arthrodactylae in tropical and subtropical regions. All the specimens which were collected in Yap and Baobeltaob Isls. were sterile or with young gametangia, but the author determined them to be *N. acuminata* by the acuminate dactyls characteristic to this species.

2. **Nitella micronesiaca** Imahori sp. nov.

Planta monoecia. Caulis gracilis et atro-virens, 40–60 cm longa; internodia 500–700μ crassa, quam ramuli 2–5plo longiora. Verticilli steriles majores, 3-furcati; radii primarii totius longitudinis 1/2 (ca. 1.5–2.5 cm longi), 210–315μ crassus; radii secundarii 6–8, 1/2–2/3 longitudinis secundariorum, 80–130μ crassus; dactyli 4–5, 1/2–3/4 longitudinis tertiariorum, 60–90μ crassus, semper 2-cellulati; cellula ultima parva 50–80μ longa, 20–25μ lata. Verticilli fertiles in capitulis densis mucosis, 2–3-furcati: radii primarii 1/2 totius longitudinis, radii secundarii 6–8, radii tertiarii 4–6, radii quaternarii 4–8. Gametangia ad nodos secundas et tertias. Oogonia solitaria, 390–420μ longa, 280–300μ lata; cellulae spirales 8–9; coronula parva, 30μ alta et 50μ lata. Antheridia 210–245μ in diametro. Oospora nigra ad atro-brunnea, 300μ longa, 240μ crassus; striis prominentibus 5–6; membra dense imperfecta reticulata.

Hab.: in lakelets. Loc.: Galdock lakelet, Baobeltaob Isl., July 28, 1939, K. I. No. 127——Type. The specimens were lost by the atomic raid.)

This species resembles *Nitella pseudoflabellata* var. *mucosa*, but it is distinguished by its size, reticulate membrane of oospore and especially by the smaller number of the furcations of branchlets. *Nitella orientalis* Allen also resembles the present species in its habits, but it is easily identified by the length of dactyls and larger number of divided branchlets in the case of *Nitella orientalis.*

3. **Nitella pseudoflabellata** A. Braun var. **mutila** A. Braun in Abh. Kön. Akad Wiss. Berlin, 1882, p. 56; Zaneveld in Blumea **4**, 1940, p. 77——*N. pseudoflabellata* A. Br. ap. Nordstedt in Act. Univ. Lund. **16**. 1880, p. 6; Braun in Abh, Kön. Akad. Wiss. Berlin, 1882, pp. 12, 54; Nordstedt in Act. Univ. Lund. **25**. 1889, p. 10; T. F. Allen in Bull. Torr. Bot. Cl. **25**, 1898, p. 77; Nordstedt in Proc. Victoria, N. S., **31**, 1918, p. 3 (nom. tant.); J. Groves in Jonrn. Soc., Bot., **46**, 1922, p. 98; ibid., 1924, pp. 361, 366; Migula in Hedwigia **70**, 1930, p. 212; Groves & Allen in Proc. Roy. Soc. Queensl., **46**, 1935, pp. 41, 44——*N. pseudoflabellata* A. Br. ap. Nordstedt var. *ramuscula* T. F. Allen in Bull. Torr. Bot. Cl. **25**, 1898, p. 78——*N. pseudoflabellata* var. *ramuscula* f. *testa-glabra* T. F. Allen in Bull. Torr. Bot. Cl. **25**, 1898, p. 79.

Plants monoecious, green to dark green. Stem 15-30 cm high, about 300 μ thick. Sterile and fertile branchlets similar, both 6-8 in a whorl, 2-3 times furcate; primary ray about ½ length of the entire branchlets, 160-200μ thick; secondary ray 5-7, about ½ length of the primary, about 100 μ thick; tertiary rays 3-5, 50-80 μ thick, of which 1-2 once more furcate 3-5 quaternary rays. Dactyls always elongated and equal in length, constantly 2-celled. ♀ and ♂ gametangia produced at the second and third nodes together. Oogonia solitary, 420-460 μ long and 270-320 μ broad, with 8-9 convolutions; coronula 35-45 μ high, 65-80 μ broad at the base. Antheridia 210-240 μ in diameter. Oospore dark brown, 290-310 μ long by 220-260 μ broad, with 6-7 ridges; membrane granulate in close vermiferous decorations.

Hab.: in rivers and rice-fields. Loc.: Korror Isl., July 23, 1939, K. I. No. 121; Airai, Baobeltaob Isl., July 26, 1939, K. I. Nos. 123-126.

Distr.: Asia (India, Indo-China, Malay Peninsula, Sumatra, Java, Borneo, Amboina, China and Japan), Oceania (New Guinea, Queensland and Victoria).

Although the elongated primary rays and the many rays of each node of branchlets show the common characacter of this species, we can say that *Nitella pseudoflabellata* is a very variable species, but these Micronesian specimens show a typical form of the variety *mutila.*

var. **minor** Imahori, var. nov. (Fig. 1)

Planta monoica, gloeocephala, 5-10 cm alta, flavo-viridis. Caulis tenuis, 300-360 μ crassus; internodia quam ramuli 1-3-plo longiora. Veticilli steriles et fertiles similes. Ramuli verticillorum 6-8, 1-3-furcati; radii primarii ½-3/5 totius longitudinis ramulorum, 120-170μ lata; radii secundarii 6-7, viz ½ longitudinem radiis primaris aequales, 80-100 μ diametro, quorum 1-4 saepe simplices; radii tertiarii 5-7, quorum 1-2 iterum furcati. Dactyli 3-5, semper 2-cellulati, elongati; cellula ultima acuta, 70-110 μ longa et basi 30-35 μ in diametro. ♀ et ♂ gametangia solitaria, raro conjuncta. Oogonia sessilia, lateralia, plerumque solitaria ad furcationes secundes et tertias, 380–440 μ longa, 260–280μ lata; cellula spirales 8–9 convolutas exhibentes; coronula parva, persistens, 40 μ alta et basi 55 μ lata. Antheridia terminalia ad furcationes primaris et secundas, 200–250 μ in diametro. Oospora aureo-brunnea, 280–300 μ longa, 220–240 μ lata et 100–140 μ crassa; striis minutis, 6–7; membrana granulata, granulis in figuris vermiformibus dispositis.

Hab.: in ponds and rice fields. Loc.: Korror Isl., July 23, 1939, K. I. No. 117——Type; Korror, July 23, 1939. K. I. No. 120; Korror, July 22, 1939, K. I. No. 112; Galdock-numa lakelet, Baobeltaob, July 28, 1939. K. I. No. 129.

This plant is akin to *Nitella pseudoflabellata* var. *mucosa*, but we can easily discriminate between the two by the smaller size, the less smaller number of the furcations of branchlets, and especially by the fertility of the first node, of the present variety. This variety very much resembles *Nitella batrachospermum*, but it is distinguished by the proportional length of each segment of the branchlets, by the weak ridges of oospores and by the decoration of oospore-membranes. The present variety also resembles *Nitella vermiculata* according to the original description, in the 1–3-times forked branchlets and vermiferous decorations of oospore-membranes, though the author has never seen a specimen of that species. This plant differs in the ♀ and ♂ gametangia which are producd at the same nodes, in the smaller oogonia and oospores, and in the more delicate decoration of oospore-membrane.

2. Key to the species of *Chara* Vailland.

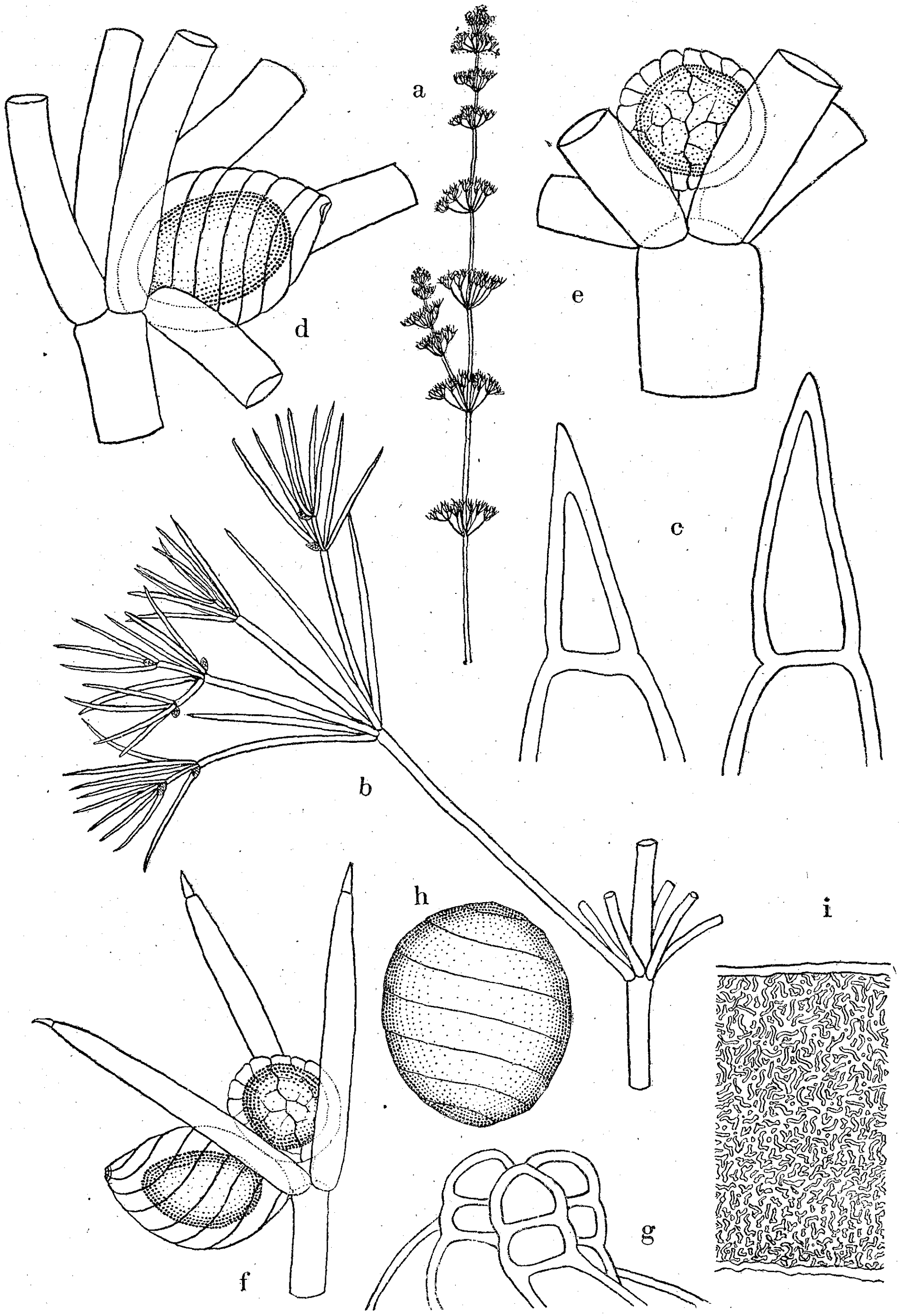
Stem corticated, branchlet entirely ecorticated ································4. *C. gymnopitys* var. *flaccida*

Stem and branchlets corticated ································5. *C. zeylanica*

4. **Chara gymnopitys** var. **flaccida** (A. Br.) Imahori, comb. nov.

Chara flaccida A. Braun in Hooker's Journ. Bot. **1**, 1849, p. 296; Wallman in Act. Soc. Linn. Bordeaux **21**, 1856, p. 52; H. & J. Groves in Philipp. Journ. Sci. **7**, 1912, p. 70; J. Groves in Philipp. Journ. Sci **19**, 1921, p. 664; ibid., in Journ. Linn. Soc., Bot., **46**, 1921, p. 102; ibid., 1924, pp. 363, 372; Pal in Journ. Linn. Soc., Bot., **49**, 1932, p. 84; Migula in Hedwigia **70**, 1931, p. 215; Dixit in Journ. Ind. Bot. Soc. **10**, 1931, p. 205; ibid., **14**, 1935, p. 261; Agharkar & Kundu in Journ. Dep. Sci., N. S. **1**, 1937, p. 15; Imahori in Journ. Jap. Bot. **22**, 1948, p. 44.——*Chara flaccida* A. Br. var. *Gaudichaudii* A. Braun in Hooker's Journ. Bot. **1**, 1849, p. 297. ——*Chara flaccida* A. Br. var. *brevibracteata*

Fig. 1. *Nitella pseudoflabellata* var. *minor* Imahori.
a) Plant. natural size. b) a branchlet, 1–3 times furcate, ×16.
c) End cells of dactyls, ×540. d) Oogonium, produced at the secondary node, ×80.
e) Antheridium, produced at the primary node, ×80.
f) Oogonium and antheridium produced at the same node, ×80.
g) Coronula, ×400. h) Oospore, ×120. i) Oospore-membrane, ×1000.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A. Braun in Braun & Nordstedt in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 129. ——*Chara Cautissii* T. F. Allen in Robinson in Bull. New York Bot. Gard. **4**, 1926, p. 272; T. F. Allen in Bull. Torr. Bot. Cl. **7**, 1880, p. 107.——*Chara fibrosa* ssp. *flaccida* Zaneveld in Blumea **4**, 1940, p. 162.

Regarding this combination, the author will discuss in a separate work.

Loc.: Marianne Isls., by Gaudichaud (herb. Agardh).

Distr.: Asia (India, Burma, Indo-China, Malaya, Sumatra, Java, Borneo, Celebes, Soemba, Philippine Isls, Japan.), N. America and Africa.

5. **Chara zeylanica** Willdenow in Mem. Ac. Roy. Berlin 1803. p. 86, 1805; Persoon, Syn. **2**, 1807, p. 530; Bruzelius & Fuernrohr in Flora **9**, 1826, p. 486; H. & J. Groves in Journ. Linn. Soc., Bot., **33**, 1897, p. 323; ibid. in Philippine Jonrn. Sci. **7**, 1912, p. 70; J. Groves in Journ. Linn. Soc., Bot., **46**, 1922, p. 102; ibid., 1924, pp. 363, 375; G. O. Allen in Journ. Bombay Nat. Hist. Soc., **30**, 1925, p. 597; Grove & Allen in Journ. Bot. **65**, 1927, p. 339; G. O. Allen in Journ. Ind. Bot. Soc. **7**, 1928, p. 65; J. Groves in Journ. Linn. Soc. Bot., **48**, 1928, p. 136; Dixit in Journ. Ind. Bot. Soc. **10**, 1931, p. 206; Pal in Journ. Linn. Soc., Bot., **49**, 1932, pp. 65, 88; Dixit in Journ. Ind. Bot. Soc. **14**, 1935, p. 262; Groves & Allen in Proc. Roy. Soc. Queensl. **46**, 1935, pp. 42, 59; Agharkar & Kundu in Journ. Dep. Sci. N. S. **1**, 1937, pp. 11, 18; Zaneveld in Blumea **3**, 1939, pp. 881, 382; ibid., **4**, 1940, p. 203; Morioka in Journ. Jap. Bot. **17**, 1941, p. 134; Imahori in Journ. Jap. Bot., **22**, 1948, p. 444; ibid. **25**, 1950, p. 76; in Bot. Mag. Tokyo, **63**, 1950, p. 233; Kazaki in Jap. Journ. Bot. **26**, 1951, p. 68. ——*Chara polyphylla* A. Br. in Regenb. Bot. Zeit. **1**, 1835, p. 70; Ibid. in Hooker's Journ. Bot. **1**, 1849, p. 299——*Chara polyphylla* var. *ceylonica* A. Br. in Hooker's Journ. Bot. **1**, 1849, p. 300——*Chara zeylonica* Willd., Kützung, Spec. Alg., 1849, p. 522——*Chara gymnopus* A. Braun in N. Denkschr. Schw. Ges. Naturw. **10**, 1849, p. 23 (nom tant.); ibid. in Monatsber. Kön. Akad. Wiss. Berlin, f. 1867, p. 870, 1868, pro parte; Daily in Butler Univ. Bot. St. **7**, 1945, p. 129.——*Chara ceylonica* (Klein) Willd.; Wallman in Act. Soc. Linn. Bordeaux **21**, 1856, p. 56.——*Chara ceylanica* Willd.; Braun in Monatens' Die Preuss. Exp. n. O. Asien, Bot. Th., 1866, p. 143.——*Chara gymnopus* A. Br. *ceylonica* A. Br. in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 197.

Cortex triplostichous, cells primary and secondary series equally developed. Spine-cells solitary, numerous and rather elongated, up to 600μ long. Branchlets 9–11 in a whorl, consisting of 9–11 articulations, of which the lowest much abbreviated, shorter than stipulodes, and ecorticated; the upper 1–3 articulations also ecorticated.

Hab.: in lakelet. Loc.: Charankanoa, Saipan Isl., July 18, 1939. K. I. No. 552. Distr.: Asia (India, Siam, Malaya, Sumatra, Java, Bali, Kai Isls., Japan and Formosa), Oceania (New Caledonia, Hawaiian Isls., N. W. Australia), North America, South America and Africa.

Although the specimens collected at Charankanoa are sterile and covered with much calcium, they are referable to the present species by the characters above described.